Technical Report - **Product specification**

# Volcanic Activity Monitoring System

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| Course: | IES - Introdução à Engenharia de Software |
| Date: | Aveiro, October 7, 2024 |
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| Project abstract: | **Volcanic Activity Monitoring System (VAMS)** is based in collecting, analysing and presenting information of volcanic activity data obtained through an API. VAMS simplifies the user experience while enriching their engagement with up-to-date, actionable data. |

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# 1 Introduction

The main objective of this project is to develop a fully functional, all-service application. In addition to the application itself, this project offers a comprehensive learning experience, covering key elements of application development such as user story creation, branch management, and agile architecture. This report outlines our journey toward accomplishing these goals.

# 2 Product concept

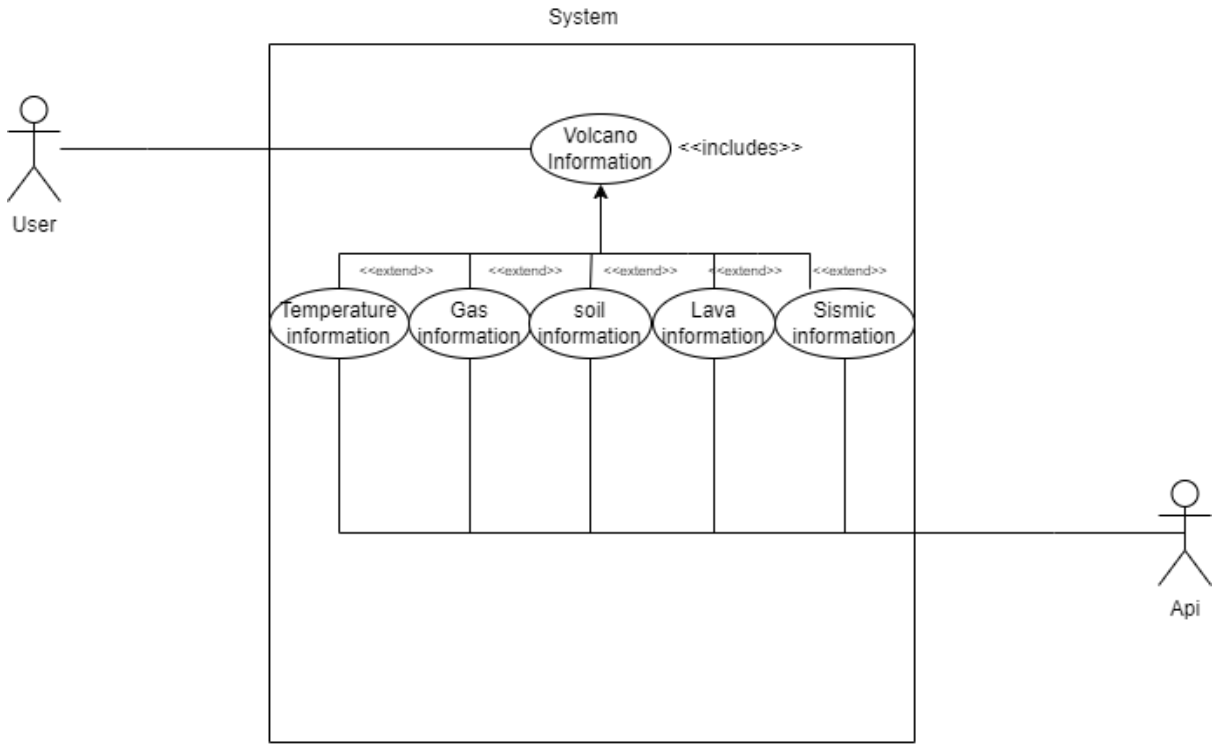
## Vision statement

VAMS focuses on the collection, analysis, and presentation of volcanic activity data sourced through a reliable API. It addresses the critical need for a more accessible and informative way of monitoring and understanding volcanic phenomena. By providing a seamless solution for gathering, organising, and displaying real-time volcanic data, VAMS enables users: whether scientists, enthusiasts, or safety authorities to stay informed about potential volcanic hazards, geological changes, and eruption predictions.

In the field of volcanology, users often struggle with accessing up-to-date data. VAMS solves this by delivering real-time notifications, detailed visualisations, and user-friendly tools that simplify the interpretation of complex volcanic activity.

While several monitoring systems exist, VAMS distinguishes itself through its intuitive interface and comprehensive approach, promoting both safety and education. It is designed to be more than just a data provider; it is an interactive platform that empowers users to engage with volcanology more effectively, making informed decisions in response to volcanic risks.

## Use-Case Diagram



# Personas and Scenarios

## Personas

**Carlos Mendoza** is a 38 years old Emergency Response Coordinator, he has a basic proficiency in web and mobile apps and his main goals are to ensure the safety of communities living near volcanoes and to communicate risks and evacuation plans effectively to local authorities and citizens.

For this he needs a simple and understandable visualisations of volcanic activity and a way to communicate complex data to non-technical audiences

**Dr. Emily Reyes** is a 45 years old Senior volcanologist at a research institute, she is proficient with data analysis software, GIS tools, and scientific programming languages. Her main goals are to study long-term patterns of volcanic activity and To access and analyse comprehensive data about volcanic gases, seismic activity, and other indicators of eruptions.

For this she needs real-time, detailed, and historical data to make accurate predictions and requires access to raw data to perform custom analyses and modelling.

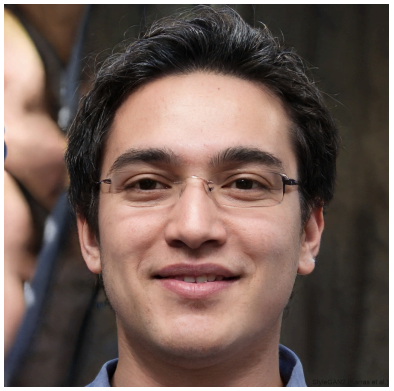
**Maria Gomez** is a 30 years old Local Resident, she has an average smartphone proficiency and her main goals are to stay informed and receive alerts about near volcanic activity.

For this she needs timely information on whether the volcano poses any risk.

**Sarah Patel** is a 32 year old Environmental Scientist who studies the environmental impact of volcanic activity on local ecosystems, she is familiar with data analysis tools and environmental monitoring software. Her main goals are to

track changes in gases and ground composition and vegetation health over time and to collaborate with other researchers on environmental impact assessments.

For this she needs detailed gas composition data to analyse environmental impact



**Jason Lee** is a 27 year old Data Analyst, he has advanced data science skills and proficiency in programming languages.

His main goals are to access data on seismic activity and gas emissions to develop a predictive model for volcanic eruptions.

For this he needs access to real-time and historical data and requires tools for data visualisation.

**Aisha Thompson** is a 22 year old, Geology Student who has an interest in volcanology, she is familiar with basic research tools, good at using web applications. Her main goals are to learn about volcano monitoring methods and data interpretation and to complete research projects for her degree using real-world data.

For this she needs access to simplified explanations of volcanic data and terms.

**David Kim** is a 40 years old Journalist who is familiar with web applications and is able to work with basic visual and multimedia tools. His main goals are to get accurate information on volcanic activity for reporting purposes.

For this he needs real time information to report breaking news.

**Anacleto José** is a 34 year old, he is a Tour Guide, who tours on an island where there is active volcanic activity, he is comfortable with using web apps. His main goals are to ensure the safety of tourists while providing an engaging, educational experience and to share accurate and interesting information about the volcano's activity, history, and geological features with tourists.

For this he needs up-to-date volcanic activity information in real time to avoid putting tourists in danger and to provide tourists with engaging stories about the volcano's activity and geological significance

### Scenarios

**Carlos**, the lead emergency planner for a government agency, receives an alert during his morning briefing about rising seismic activity near **Santa Barbara volcano**, a volcano located near several populated villages. He enters on the volcano monitoring website on his tablet and sees that both seismic and gas emission levels have spiked above normal levels. He quickly checks the real-time risk assessment on the dashboard, which shows an increased likelihood of an eruption within the next 48 hours. Carlos the assess the situation and based on the information provided, Carlos coordinates an emergency response meeting with local officials

**Dr. Emily Reyes** is researching the **Santa Barbara volcano** . She's preparing a paper on how gas emissions, specifically sulphur dioxide ($SO_2$), correlate with eruption events. Using the volcano monitoring website, she pulls up historical data on gas emissions and seismic activity from the past 10 years for the volcano. To investigate further, Emily downloads the raw data and imports it into her data analysis software.

**Maria** lives with her family near **Santa Barbara volcano**. While cooking dinner, Maria receives a notification on her phone. The alert indicates that seismic activity around the volcano has increased to a yellow alert level, meaning potential danger but no immediate risk. Maria checks VAMS website, which uses a colour-coded system to show the current risk level: yellow. She then prepares for evacuation.

**Sarah** is an environmental scientist studying the impact of volcanic emissions on air quality and local ecosystems around **Santa Barbara volcano**. Recently, local vegetation near the volcano has been dying off, and Sarah suspects that changes in sulphur dioxide levels might be affecting plant health. She accesses the volcano monitoring app to retrieve data on $SO_2$ emissions over the past several months. Sarah overlays the $SO_2$ data with weather patterns and vegetation health reports.

**Jason**, a data analyst working with a volcano observatory, is tasked with creating predictive models to forecast eruptions of **Santa Barbara volcano**. He needs access to both real-time and historical data on seismic activity, ground deformation, and magma viscosity. Using the app, Jason downloads large datasets covering the past 30 years of volcanic activity. He imports the data into his machine learning software and begins building models to identify patterns that precede eruptions.

**Aisha**, an undergraduate geology student, is working on a project about the volcanic activity of **Santa Barbara volcano**. She needs to understand how gas emissions and seismic activity relate to eruptions. She enters the volcano monitoring website to access historical data from the volcano. The app provides a student-friendly interface with simplified explanations and visualisations. Aisha then downloads data on past eruptions, focusing on the seismic and gas data leading up to each event.

**David** is a journalist writing a story about the recent activity at **Santa Barbara volcano**. He needs real-time, reliable information to report on whether the volcano is close to erupting. David opens the volcano monitoring website and sees that seismic activity and gas emissions have both been increasing steadily over the past week. The app provides visual graphs with the information over time, which he downloads to include in his article.

**Anacleto**, a tour guide, is leading a group of tourists on a tour around **Santa Barbara volcano**. He frequently checks the volcano monitoring website to ensure the group's safety. During the tour, Anacleto receives an alert on his phone indicating a small increase in seismic activity. He pauses the tour and checks the website's real-time risk assessment, which shows that the risk is still low, but he decides to reroute the group to avoid areas near the crater.

## Product requirements (User stories)

1. As an emergency response coordinator, I want to see a dashboard of key indicators (seismic activity, gas levels, ground movement) with easy-to-understand visuals so I can assess the current risk quickly.
2. As a volcanologist, I want to view real-time data on seismic activity and gas emissions for a selected volcano so that I can monitor potential signs of an eruption.
3. As a local resident, I want to see how close the activity or potential danger is to my home, so I can make decisions on whether to evacuate.
4. As an environmental scientist, I want to analyse gas emission trends to assess their impact on local air quality and ecosystems.

5. As an environmental scientist, I want to view ground composition data and changes over time, so I can study how volcanic activity affects soil health and plant life.
6. As a data analyst, I want to visualise trends in ground deformation and magma viscosity over time, so I can identify key indicators of future eruptions.
7. As a geology student, I want to access simplified explanations of volcanic data (e.g., magma viscosity, seismic activity) so that I can better understand how volcanic monitoring works.
8. As a journalist, I want to embed maps, graphs, or data visualisations from the platform into my articles or reports, so I can present information in a visually appealing way.
9. As a tour guide, I want to share interesting facts about the volcano's recent activity, eruption history, and geological details with my group, so I can provide an educational and exciting experience.